IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Larry C. Olsen et al.

Application No. 10/726,744

Filed: December 2, 2003

Confirmation No. 6833

For: THERMOELECTRIC DEVICES AND APPLICATIONS FOR THE SAME

Examiner: Jeffrey Thomas Barton

Art Unit: 1795

Attorney Reference No. 23-65037-01

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AMENDMENT

This responds to the Office action dated March 3, 2010. Please amend the referenced application as follows:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2.

Remarks begin on page 6.

Listing of Claims

1. (Previously presented) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a plurality of thermoelectric couples with the thermoelectric couples comprising:

(a) a co-sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a co-sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement;

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein x and y form a non-stoichiometric compound and wherein *x* is about 2 and *y* is about 3; and

wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration.

2. (Withdrawn) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a plurality of thermoelectric couples with the thermoelectric couples comprising:

(a) a sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement;

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein and *x* is about 2 and *y* is about 3;

wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration; and

wherein the p-type or the n-type thermoelements have L/A ratios from about 500 cm^{-1} to about 10,000 cm^{-1}.

3. (Previously presented) The thermoelectric power source of claim 1 wherein the p-type and the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, wherein *x* is about 2 and *y* is about 3.

4. (Canceled)

5. (Previously presented) The thermoelectric power source of claim 1 wherein the thermoelectric power source has a power output of from 50 μW to 1 W.

6. (Previously presented) The thermoelectric power source of claim 1 further comprising at least about 50 thermoelectric couples, wherein the thermoelectric power source has a power output of at least about 1 μW with a voltage of at least about 0.25 volt.

7. (Original) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

8. (Previously presented) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 0.1 mm in thickness.

9. (Original) The thermoelectric power source of claim 1 further comprising at least about 1000 thermoelectric couples, wherein the thermoelectric power source has a power output of about 1 W with a voltage of at least about 1 volt.

10. (Previously presented) The thermoelectric power source of claim 1 wherein the p-type thermoelements each have a first width, the n-type thermoelements each have a second width, and the first width is different from the second width.

11. (Original) The thermoelectric power source of claim 1 wherein two or more p-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned p-type thermoelements are electrically connected in series to n-type thermoelements.

12. (Previously presented) The thermoelectric power source of claim 1 wherein the thin film p-type thermoelements or the thin film n-type thermoelements comprise Bi_xTe_y and Sb_xTe_y, or Bi_xTe_y and Bi_xSe_y.

13. (Original) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

14. (Original) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and provides voltages of greater than about 1 volt.

15. (Original) The thermoelectric power source of claim 14 wherein the thermoelectric power source produces power at temperature differences of about 20°C or less.

16. (Original) The thermoelectric power source of claim 1 wherein two or more n-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned n-type thermoelements are electrically connected in series to p-type thermoelements.

17. (Previously presented) The thermoelectric power source of claim 1 wherein the n-type or the p-type thermoelements comprise Sb_xTe_y, Bi_xTe_y and Sb_xTe_y, or Sb_xTe_y and Bi_xSe_y.

18. (Previously presented) The thermoelectric power source of claim 1 wherein the n-type or the p-type thermoelements comprise Bi_xTe_y and Sb_xTe_y.

Claims 19 – 22 (Canceled)

23. (Withdrawn) A thermoelectric power source comprising:

multiple thermocouples electrically connected to one another on an upper surface of a single flexible substrate, the thermocouples comprising:

sputter deposited thin film p-type thermoelements having thicknesses of 0.1 mm or greater;

sputter deposited thin film n-type thermoelements alternatingly positioned adjacent the p-type thermoelements, the n-type thermoelements having a thickness of about 0.1 mm or greater;

wherein the thermoelectric power source has a volume of less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W generated by the thermocouples on the single flexible substrate; and

wherein the p-type thermoelements or the n-type thermoelements comprise a Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y alloy where x is about 2 and y is about 3.

24. (Withdrawn) The thermoelectric device of claim 23 wherein said multiple thermocouples electrically connected to one another are in series-parallel.

25. (Withdrawn) The thermoelectric power source of claim 23 wherein the p-type thermoelements have L/A ratios greater than about 500 cm^{-1}.

Claims 26 – 36 (Canceled)

37. (Previously presented) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a thermoelectric couple comprising:

(a) alternating thin film p-type and n-type thermoelements positioned on the upper surface of the flexible substrate;

(b) an electrically conductive member positioned on the flexible substrate, and electrically connecting a first end of the p-type thermoelement with a second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Sb_xTe_y or Bi_xSe_y wherein x is about 2 and y is about 3; and

(c) wherein the flexible substrate is in a coil configuration.

38. (Previously presented) The thermoelectric power source of claim 37 wherein the p-type thermoelements or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

39. (Previously presented) The thermoelectric power source of claim 37 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

REMARKS

Claims 1-3, 5-18, 23-25 and 37-39 are pending in the present application. Reconsideration is respectfully requested.

Claim Rejections - 35 USC § 103

Claims 1, 3, 5-10, 12-15, 17, 18, and 37-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Migowski (WO 89/07836; references below are made to the English translation of this documents provided by Applicant) in view of Böttner. Applicants traverse.

Claim 1: The Examiner acknowledges that Migowski does not teach or suggest thermoelectric elements formed of non-stoichiometric or co-sputter deposited thin film materials as disclosed and claimed in the present application. Contrary to the Examiner's assertions, Böttner also fails to teach or suggest such compounds as the disclosure does not provide sufficient detail for one of ordinary skill in the art to make the compounds for which it is being cited by the Examiner. That is, Böttner does not enable one of ordinary skill in the art to produce the disclosed and claimed non-stoichiometric compounds of the present application or even the compounds disclosed in the Böttner reference itself.

Prior art references must be enabling for a person skilled in the art to practice the invention as claimed. See, e.g., MPEP §§ 2131.01(A) and 2121.01. Thus, for an Examiner to rely on Böttner in a prior art rejection, the reference must teach how to make the claimed thin film materials.[1]

> The disclosure in an assertedly anticipating reference must provide an enabling disclosure of the desired subject matter; mere naming or description of the subject matter is insufficient if it cannot be produced without undue experimentation. *Elan Pharm., Inc. v. Mayo Found. For Med. Educ. & Research*, 346 F.3d 1051, 1054, 68 USPQ 2d 1373, 1376 (Fed. Cir. 2003).

The naming of a compound in a reference, without more, cannot constitute a description of the compound and the reference is not enabling prior art. One of ordinary skill in the art must be able to make or synthesize the compound for the reference to be considered enabling prior art for the teaching of the compound to be made. See, MPEP § 2121.02 and *In re Hoeksema*, 399 F.2d 269, 158 USPQ 596 (CCPA 1968). As set forth in the § 1.132 Declaration of Paul McClelland, the Böttner reference does not enable a person of ordinary skill in the art to make the claimed non-stoichiometric compounds or even enable a skilled person to make the compounds Böttner himself discloses.

[1] In *In re Kubin*, 561 F.3d 1351 (Fed. Cir. 2009) **the court further confirmed** the court's holding in *In re O'Farrell*, 853 F.2d 894 (Fed. Cir. 1988), **as reinvigorated by the court in *KSR*** (*KSR Int'l Co. v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), **that the cited references must contain "detailed enabling methodology for practicing the claimed invention**, a suggestion to modify the prior art to practice the claimed invention, and evidence suggesting that it would be successful."

Accordingly, at least for the reasons listed above, claim 1 is allowable over the art of record.

Claim 3: Claim 3 recites the power source of claim 1 wherein the p-type and the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y, wherein x is about 2 and y is about 3.

None of the references of record, whether considered individually or in combination, teach or suggest having tertiary p-type and n-type thermoelements comprising all of Bi_xTe_y, Sb_xTe_y, and Bi_xSe_y. As the Examiner acknowledges on p. 5 of the Office Action, Böttner does not in any manner disclose or even contemplate a tertiary thin film TE material. The Examiner merely states such would be obvious because Böttner mentions bismuth selenide and bismuth and antimony tellurides – not only is a *prima facie* case of obviousness not adequately supported, there is no enablement of such in Böttner. Böttner does not even mention any tertiary thin film TE materials, let alone the materials recited in the present claim 3. Clearly, without even mention of such materials, Böttner fails to enable the making of such. Accordingly, in addition to the reasons set forth above for claim 1, claim 3 is allowable for these reasons as well.

Claim 5: Claim 5 recites the thermoelectric power source of claim 1 wherein the thermoelectric power source has a power output of from 50 μW to 1 W.

The Migowski disclosure does not teach or suggest a TE power source capable of producing from 50 microwatts to 1 W of electrical power and Böttner fails to make up for the deficiency of Migowski.

As the Examiner acknowledges in the Office action (page 4), the Migowski reference indicates that its device produces a power of only 11 microwatts. (Migowski page 4, second full paragraph beginning with "Layer thickness ...".) There is no indication in Migowski of a power source having a power output in the range claimed and the Examiner's statement that it is merely a matter of application of the device and that "choice of element length, width, and thickness is known in the art to affect the power output available from a thin film thermocouple device ... " with nothing more, no cited reference or other support for the conclusory statement, is not sufficient to support a *prima facie* case of obviousness. See, e.g. MPEP § 2144.03.

Furthermore, the record in this application is replete with evidence that certain parameters of the present invention, such as L/A ratios and the stoichiometry of the claimed TE thin film materials, are manipulated to produce the disclosed device having the claimed output and the criticality of various parameters have been shown. As recognized by the Examiner, the power output of the TE power source is based on the recited structure – the power output is not merely an intended end use. The power output limitation defines, in part, the claimed underlying structure. The specification indicates numbers of thermocouples, L/A ratios of the thin films, thin film compositions, etc. that can be used to form the recited device having the recited power output. Each of those embodiments need not be specifically recited - the limitation of power output dictates structure, acting as a form of structural limitation itself.

For at least these reasons, and those set forth above in relation to claim 1, claim 5 is allowable over the art of record.

Claims 6-10, 12-15 and 18 are allowable for the reasons set forth above in relation to claim 1 and for each claim's unique and non-obvious combination of features.

Claim 17: Claim 17 recites the thermoelectric power source of claim 1 wherein the n-type or the p-type thermoelements comprise Sb_xTe_y, Bi_xTe_y and Sb_xTe_y, or Sb_xTe_y and Bi_xSe_y. As discussed above, none of the references of record, whether considered individually or in combination, teach or suggest (or enable the making of) tertiary or binary p-type and n-type thermoelements comprising all of Sb_xTe_y, Bi_xTe_y and Sb_xTe_y, or both of Sb_xTe_y and Bi_xSe_y. Accordingly, in addition to the reasons set forth above for claim 1, claim 17 is allowable for this reason as well.

Claims 37-39 recite the p-type or the n-type thermoelements comprise Sb_xTe_y or Bi_xSe_y wherein x is about 2 and y is about 3. As discussed above, nothing in Migowski or Böttner teach or suggest with sufficient enablement, Sb_xTe_y or Bi_xSe_y thermoelement materials. Accordingly, claims 37-39 are allowable over the art of record.

Claims 11 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Migowski and Böttner as applied to claims 1, 3, 5-10, 12-15, 17, 18 and 37-39 above, and further in view of Bass et al. (US 6,207,887). Applicants traverse.

Because, as discussed above, Böttner fails to make up for the deficiencies of Migowski (and because Bass has no disclosure that could even arguably make up for the noted deficiencies of Migowski and Böttner) at least for the reasons listed above, claims 1, 3, 5-10, 12-15, 17, 18 and 37-39 are allowable over the art of record.[2]

Respectfully submitted,

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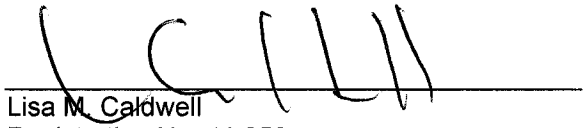
By 

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[2] Prior Amendments note other reasons supporting the patentability of these claims over the recited rejections and are re-submitted, though not reiterated, herein.